Precision Strike

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EXCALIBUR XM982

Presented To:

Precision Strike Association
Summer PEO Forum

Presented By:

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Distribution A. Approved for public release; distribution is Unlimited

Excalibur Basics

- 155 mm Precision-Guided Extended Range Munition for Cannc
- Cooperative development
  - ✓ USA and Sweden
- Family of Munitions

UNITARY
Block I

SMART
Block II

DISCRIMINATIN
G
Block III

Raytheon

TACOM ARDEC

BOFORS DEFENCE

TSM CANNON

FMV

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Block I Variants and Requirements

- **Block Ia-1** Initial Capability
- **Block Ia-2** Improves on Ia-1 performance; more reliable, capable of higher charge level, tested anti-jam
- **Block Ib** Compact guidance section; more capable, more reliable, lower cost, could add SAL seeker

	Unitary Block		
Capability	**Block Ia-1**	**Block Ia-2**	**Block Ib**
Delivery Accuracy	10-20m CEP (U)	10-20m CEP (U)* 20-30m CEP (J)	10m CEP (U)* 20m CEP (J)*
Range	24-26 km	39-cal: 30-40 km 52-cal: 50-60 km	39-cal: 35-40 km* 52-cal: 50-60 km
Reliability	>60%	85+%*	90+%*
Effectiveness	ORD Threshold (M107)	ORD Threshold* (M107)	ORD Threshold* (M107)
Platform & Charge	LW155 (TAD) Paladin MACS 3-4	LW155 (TAD) Paladin NLOS-C FH77BD MACS 3-5	LW155 (TAD) Paladin NLOS-C FH77BD MACS 3-5

*Denotes KPPs in addition to Interoperability-Top Level IERs. Block Ia-1 has no KPPs.

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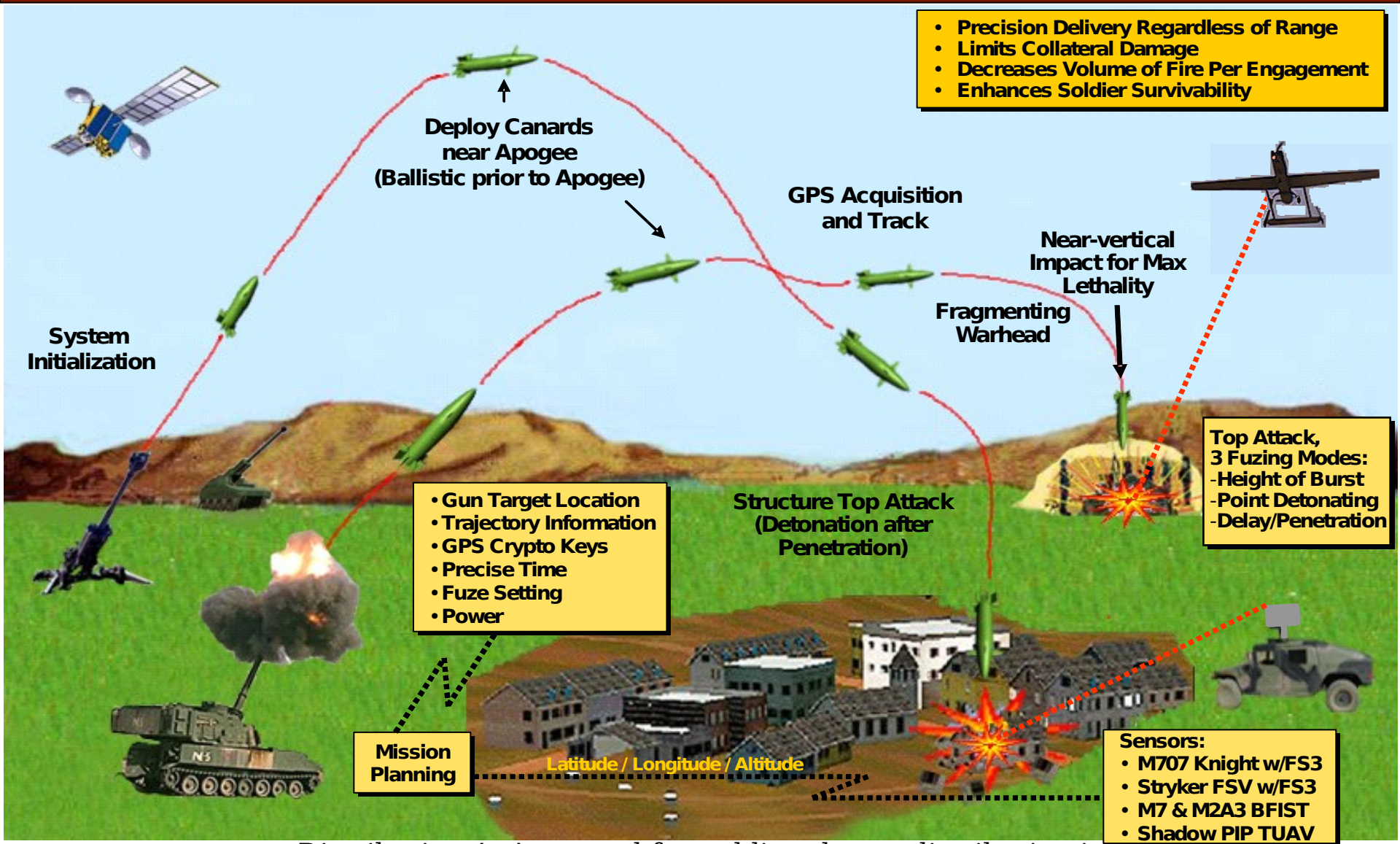
Operational Concept



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Operational Scenario Animation

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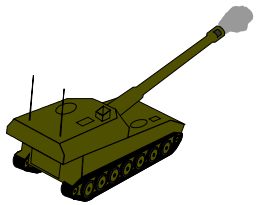
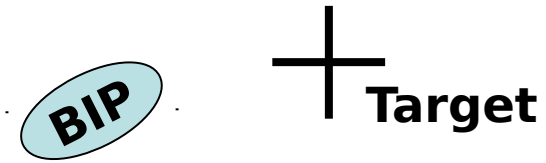
Excalibur Safety Features

- **Excalibur will be the most insensitive Artillery projectile in the inventory**
- **Positive Feedback on Fuze Setter; Soldiers & Marines will know fuze is set**
- **Base Cover lands in Danger Area Echo (~250 meters from gun)**
- **Two arming environments (setback & spin); fuze safe for overhead fire**
- **Fuze will not arm until round is within 3 sec TOF to aim point**
- **FDC will compute Ballistic Impact Point (BIP)**
  - ✓ **AFATDS computes default BIP on gun-target line**
  - ✓ **FDC examines default BIP and either accepts or selects a different (safe) area**
  - ✓ **FDC selected area for new BIP (e.g., a FFA) need not be on gun-target line**
  - ✓ **If necessary, FDC enters new BIP location into AFATDS & re-computes mission**
  - ✓ **If round fails in-flight self-test then canards will not deploy & fuze will not arm**
  - ✓ **Faulty round would impact in BIP and warhead would not detonate**





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Insensitive Munitions Summary

Requirement	System Reaction Type / Assessment	Comment
Bullet Impact (BI)	Not more severe than Type 5	Type 5	
Fragment Impact (FI)	Not more severe than Type 5	Type 5	
Sympathetic Detonation (SD) Diagonal Acceptor	No Type 1	<Type 1	
Sympathetic Detonation (SD) Adjacent Acceptor	No Type 1	<Type 1	
Fast Cook-Off (FCO)	Not more severe than Type 5	Type 5	
Slow Cook-Off (SCO)	Not more severe than Type 5	Type 4	Warhead reacted after ~7 hours in the oven. Intend to request waiver for initial production and incorporate design improvements in future production buys. Potential to improve reaction by changing warhead liner design or changing explosive fill.
Shaped Charge (SC)	No Type 1	**By Analysis**	Waiver Planned.

Excalibur more insensitive than any other Artillery Projectile in the inventory.

Will seek waiver for Slow Cook-Off and Shape Charge Jet Impact.

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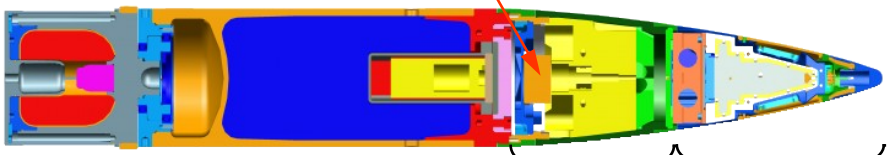
Technical Progress Summary 1

Inertial Measurement

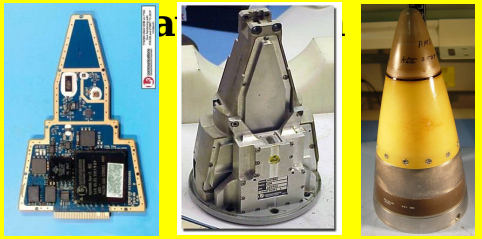
IMU



4-Axis CAS GNU

- ✓ IMUs survived tests at MACS-5
- ✓ Continuing with 2 vendors
  - ✓ Honeywell
  - ✓ BAE

Guidance &



Canard Actuator System

- ✓ Survived Overstress Airgun Test, 17kGs and Gunfire at MACS 4
- ✓ Canards deployed & guided to target during GG-A

- ✓ GNU Electronics demonstrated gun-hardening gun firing tests (MACS-5)
  - ✓ Mission Computer
  - ✓ Power Conditioning Unit
  - ✓ GPS Receiver
  - ✓ AI Boards

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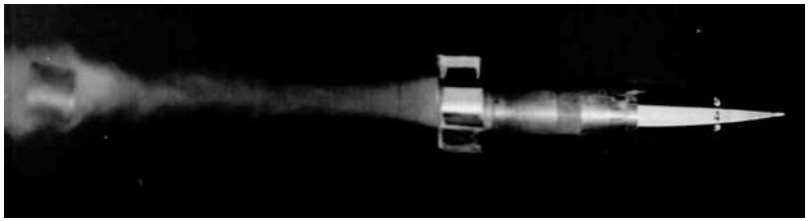
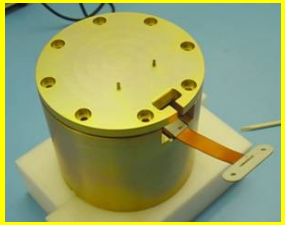
Technical Progress Summary 2

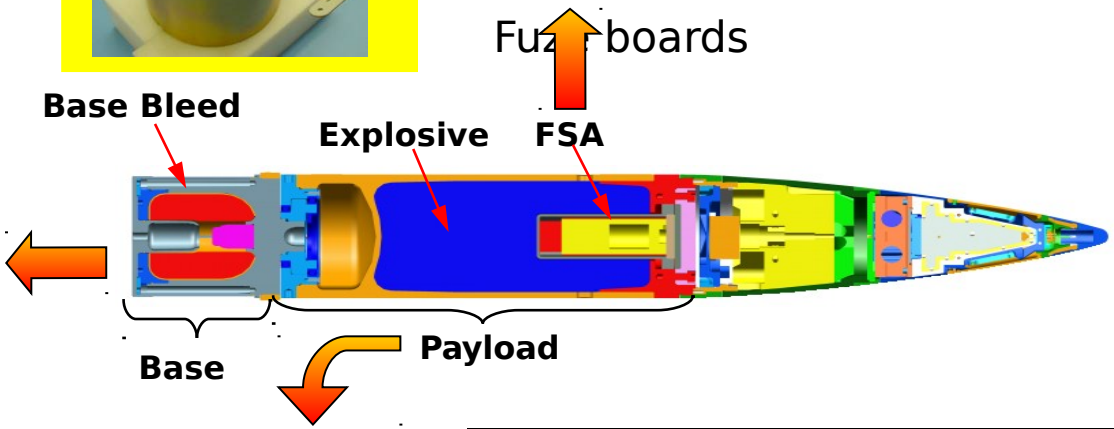


Base with Fins

Fuze Safe & Arm

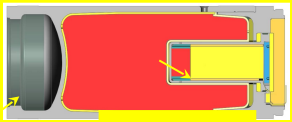


- ✓ Tactical design established
- ✓ Second Arming defined
- ✓ Accepted by US & Swedish Fuz[illegible] boards

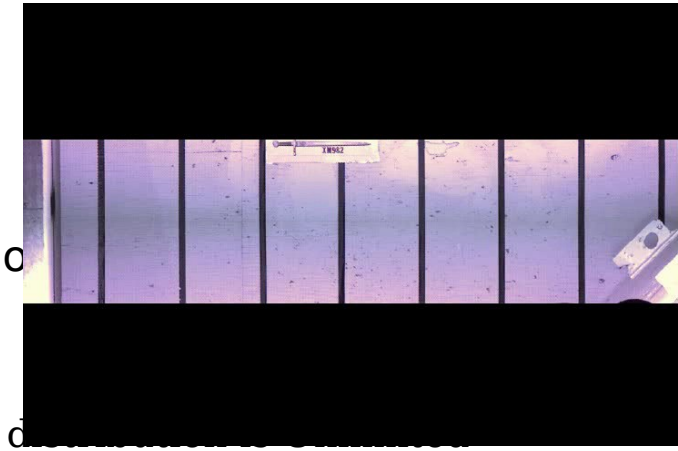


- ✓ Base with Roll Control tested – will support Early Fielding Block Ia-1
- ✓ Base Bleed development ongoing for Block Ia-2

Unitary Payload



- ✓ Arena, penetratio and IM tests completed



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Excalibur Container & Pallet

- Each Excalibur projectile comes in its own foam-filled steel container
  - ✓ Provides Environmental Protection over lifecycle
  - ✓ Helps meet Insensitive Munitions requirements
  - ✓ Successful container CDR; Meets all reqmts
  - ✓ Pallet testing successfully completed
- Nine containers to a pallet
- Straps inside speed projectile removal

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ACCURACY:
Demonstrated at Guided Gunfire A Test Series

Range to target: 20 Kilometers

Objectives

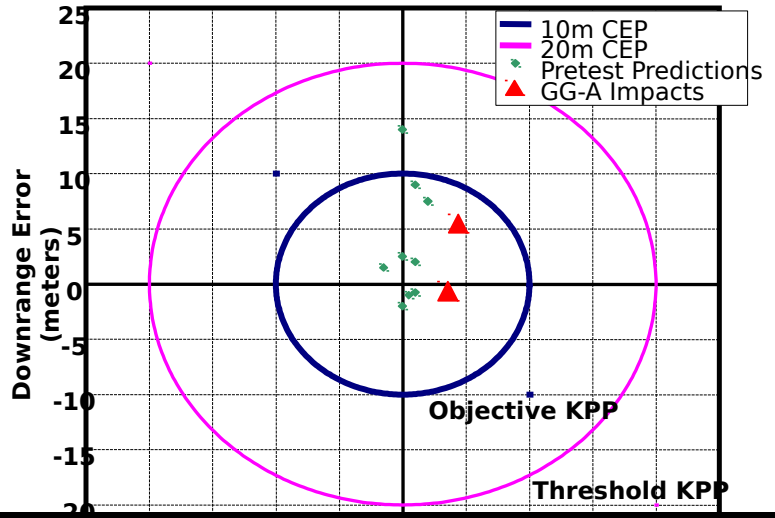
- Demonstrate that projectile de-rolls when commanded, correctly orients, acquires GPS, calculates a navigation solution and guides a non-ballistic trajectory to a point on the ground

Configuration

- 3 Projectiles fired at MACS-4 charge from LW155 & Paladin cannons
  - Guidance & Navigation Unit (GNU)
    - Tactical computer & flight software
    - C/A Code (civilian) GPS
  - Tactical Canard Actuator System (CAS)
  - Encrypted Telemetry System (in place of tactical HE warhead)

Results

- ✓ <u>All objectives successfully met</u>; 2 of 3 rounds impacted in target area
  - ✓ Demonstrated Accuracy: 3.4m & 6.9m
  - ✓ Full Functionality of Guidance and Navigation System
  - ✓ Guided to Programmed Target Location
  - ✓ Performed Terminal Tip over Maneuver over Target
  - o Projectile #2 flew ballistic
    - Shortcoming of GPS C/A code caused large change in navigation solution, projectile went into fail safe mode



Scene Trigger Frame 12
220 [START] +003883
04/12/18 19:40:39
982 Impact 18 Dec 04
4 READY 780 0 250 1/10K
ID Status Play Rec Shutter

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Urgent Fielding Effort

- **On 24 March the Army Resources & Requirements Board on validated the CFLCC Urgent Need Statement for a precision cannon munition**
  - ✓ **Excalibur designated as the materiel solution**
  - ✓ **Recommended allocating additional funding**
- **On 14 April Excalibur Conducted MS C Review**
  - ✓ **Brief conducted five months early**
  - ✓ **Acquisition Decision Memorandum signed 23 May**
- **On 27 May OSD approved the TEMP to support Urgent Fielding**
- **In mid June Army allocated additional funding**
- **On 22 June Army signed a Low Rate Initial Production contract with Raytheon**
- **Program on track to field projectiles to CFLCC in Iraq by the end of March 2006**

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Urgent Fielding Fuze Setter

- **Schedule does not allow integration of EPIAFS with host howitzers**
- **Picatinny is developing a stand-alone Excalibur fuze setter using EPIAFS and off-the-shelf components**
  - ✓ **EPIAFS Fuze Setter, PIK and Cable**
  - ✓ **Ruggedized Personal Digital Assistant (RPDA)**
  - ✓ **SINCGARS ASIP Radio**
  - ✓ **DAGR GPS and Remote Antenna**
- **Communicates with AFATDS/BCS**
  Emulates an M109A6 Paladin
- **Envisioned for Paladin Units**
  (but should work with any 155mm/39cal system)

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Major Upcoming Test Events

- Guided Gunfire B
  - ✓ Demonstrate initialization, projectile flight performance and Fuse Mode functionality
  - ✓ Various ranges and charges
  - ✓ Exposure to environmental conditioning
- Sequential Environmental Tests - Safety
  - ✓ Extreme environmental conditioning
  - ✓ Loose cargo and drop testing
  - ✓ Sand & Dust exposure
  - ✓ Fired at charges up to PIMP+5%
- First Article Test for XM982 (Block Ia-1)

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Questions?

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